U.S. DEPARTMENT OF COMMERCE
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PB-266 397

Immediate Water Pollution Control Needs Middle Arkansas River Basin: Colorado, Kansas, New Mexico, Oklahoma & Arkansas

Federal Water Pollution Control Administration, Dallas, Tex

Apr 67

PB 266 397

IMMEDIATE WATER POLLUTION CONTROL NEEDS

MIDDLE ARKANSAS RIVER BASIN

COLORADO, KANSAS, NEW MEXICO, OKLAHOMA AND ARKANSAS

U. S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTH CENTRAL REGION
DALLAS, TEXAS 75202

APRIL 1967

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SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA *(Please read Instructions on the reverse before completing)*		
1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE IMMEDIATE WATER POLLUTION CONTROL NEEDS MIDDLE ARKANSAS RIVER BASIN COLORADO, KANSAS, NEW MEXICO, OKLAHOMA AND TEXAS		5. REPORT DATE April 1967 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Federal Water Pollution Control Administration Dallas, Texas		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Protection Agency 1201 Elm Street Dallas, Texas 75270		13. TYPE OF REPORT AND PERIOD COVERED 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

The purpose of the report is to focus attention on known sources of water pollution in this area and to provide a priority for action to correct existing problems and to prevent future problems.

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Water Pollution Control ARkansas River Basin Colorad Kansas New Mexico Oklahoma Arkansas		
18. DISTRIBUTION STATEMENT Release unlimited - Available from NTIS	19. SECURITY CLASS *(This Report)* 20. SECURITY CLASS *(This page)*	21. NO. OF PAGES 30 22. PRICE PC A03, MF A01

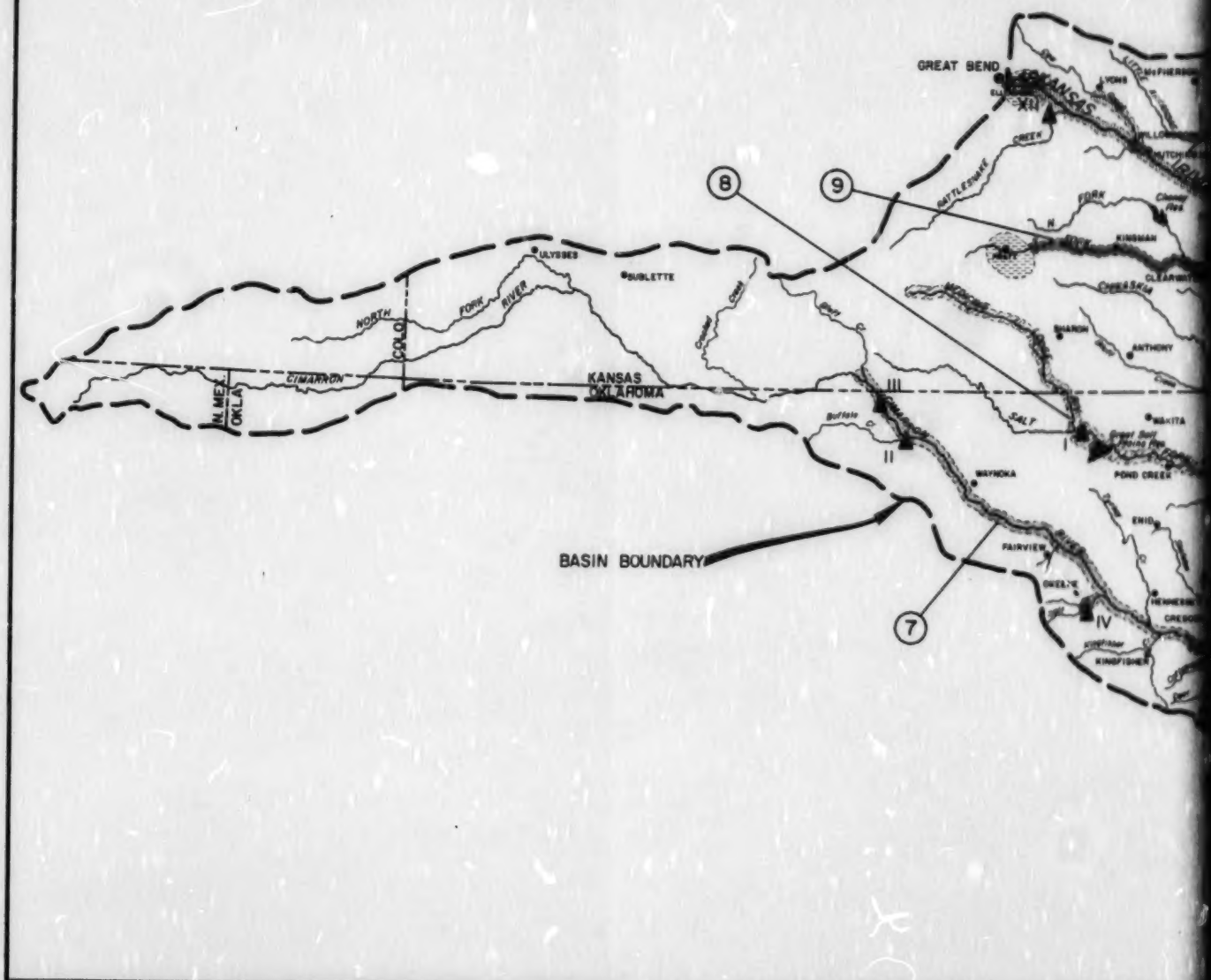
EPA Form 2220-1 (9-73)

I. Introduction

The purpose of this report is to focus attention on known sources of pollution and to provide a priority for action to correct the existing water pollution problems and prevent future problems in the Arkansas River between Great Bend, Kansas, and Fort Smith, Arkansas (see Figure 1), an interstate stream and its tributaries. This report is based on compilations of available data of the Federal Water Pollution Control Administration, South Central Region, and the pollution control agencies of Colorado, Kansas, New Mexico, Oklahoma, and Arkansas. No detailed water quality surveys or engineering studies were carried out for the preparation of this report.

The findings of this report are based on the best information available at this time on water quality conditions and immediate and potential pollution abatement needs. The omission of any particular town, industry, or other establishment from this report does not imply that an immediate or potential pollution abatement need may not exist in that particular area. Priorities listed are based solely on an evaluation of the Middle Arkansas River Basin and not on a relative basis with other basins in the South Central Region.

Authority is given in Section 3 (a) of the Federal Water Pollution Control Act, as amended, for the preparation or development of comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries thereof and improving the sanitary conditions of surface and underground waters. This report by describing the immediate needs for controlling water pollution in the Middle Arkansas River Basin represents another step in the development of a comprehensive program to control water pollution in the basin.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KANSAS
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NORTH FORK RIVER
CIMARRON
COLO.
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OKLA.
ANTHONY
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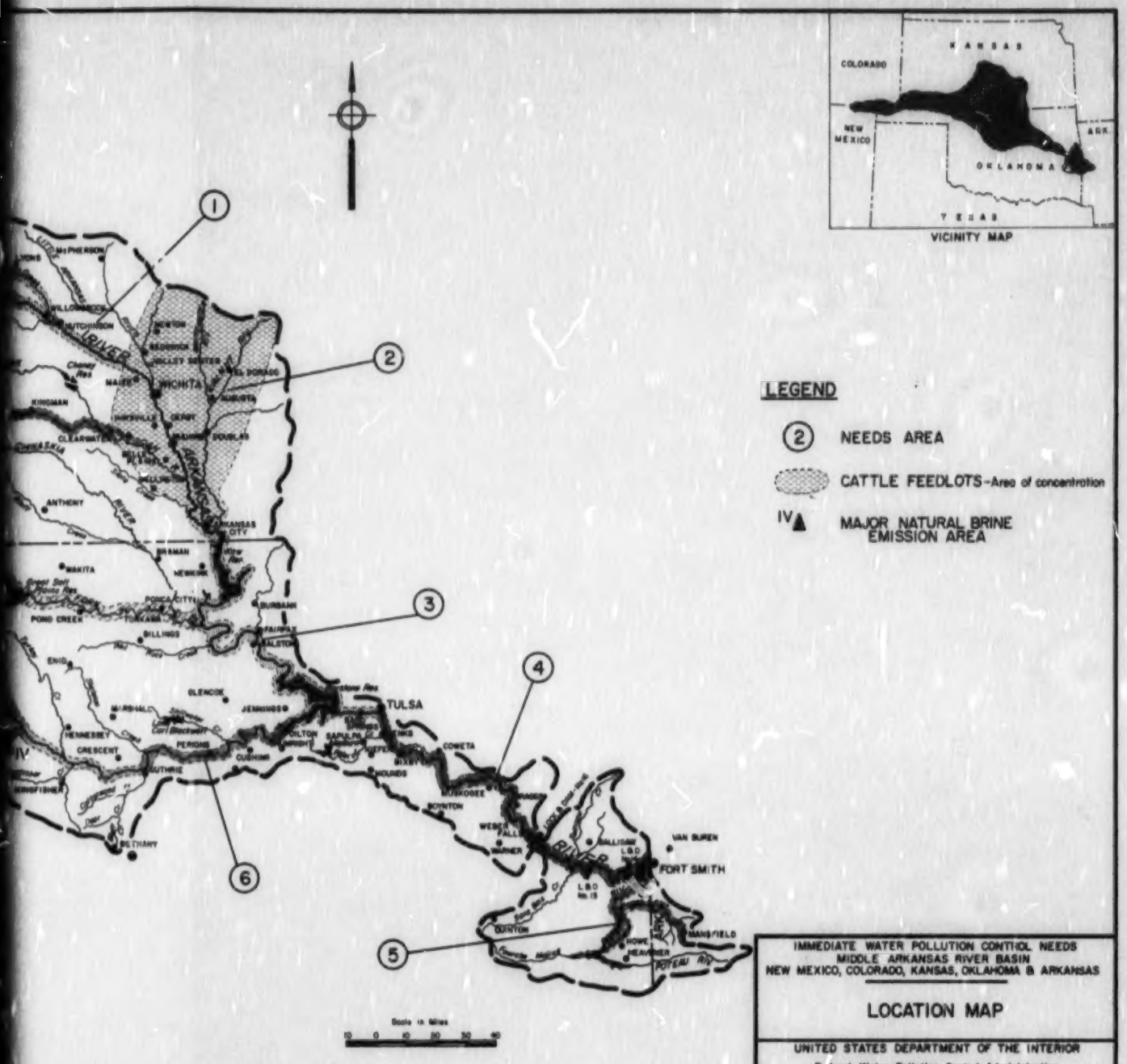
KANSAS
COLORADO
NEW MEXICO
OKLAHOMA
ARK.
TEXAS
VICINITY MAP
LEGEND
2 NEEDS AREA
CATTLE FEEDLOTS-Area of concentration
IV MAJOR NATURAL BRINE EMISSION AREA
1
2
3
4
5
6
WICHITA
TULSA
FORT SMITH
ARKANSAS RIVER
Scale in Miles
IMMEDIATE WATER POLLUTION CONTROL NEEDS
MIDDLE ARKANSAS RIVER BASIN
NEW MEXICO, COLORADO, KANSAS, OKLAHOMA & ARKANSAS
LOCATION MAP
UNITED STATES DEPARTMENT OF THE INTERIOR
Federal Water Pollution Control Administration
SOUTH CENTRAL REGION
JUNE 1967
DALLAS, TEXAS

FIGURE 1

II. Summary of Immediate Pollution Control Needs

Pollution problems in the Middle Arkansas River Basin, as indicated by septic conditions, oxygen depletion and high mineral concentrations, include damages to fish life, deterioration of municipal and industrial water supply, degradation of aesthetics, and impairment of recreation uses. The immediate pollution control needs are listed in the following tabulation and grouped into categories: waste treatment, natural pollution control, flow regulation, other pollution control practices, institutional practices, and research. Location designations refer to Figure 1.

Location	Responsibility	Need	Priority
Waste Treatment			
1	City of Willowbrook, Kansas	New treatment plant	A
	City of South Hutchinson, Kansas	Plant expansion	B
	American Salt Co. Lyons, Kansas	Provide waste injection well	A
	City of McPherson, Kansas	Plant expansion	B
2	City of Haysville, Kansas	New treatment plant	A
	Maurer-Neuer Meat Packers, Arkansas City, Kansas	Plant expansion	B
	City of Maize, Kansas	Plant expansion	B
	City of Park City (Wichita) Kansas	Plant expansion	B

Location	Responsibility	Need	Priority
Waste Treatment (Continued)			
2	City of Derby, Kansas	Add secondary treatment	B
	City of N. Derby, Kansas	Add secondary treatment	B
	City of Mulvane, Kansas	Add secondary treatment	B
	Sawhawk Imp. Dist. Wichita, Kansas	Connect to Wichita system	B
	City of Oaklawn (Wichita) Kansas	Connect to Wichita system	B
	McConnell AFB Wichita, Kansas	Provide industrial waste injection well	A
3	City of Burbank, Oklahoma	Add secondary treatment	B
	City of Ponca City, Okla.	Add secondary treatment	B
	City of Ralston, Oklahoma	Add secondary treatment	B
	City of Newkirk, Oklahoma	Add final settling	B
	City of Fairfax, Oklahoma	Plant expansion	B
	U S. Corps of Engineers Recreation Areas, Keystone Dam and Res., Oklahoma	Provide vault type toilets	B

Location	Responsibility	Need	Priority
Waste Treatment (Continued)			
4	City of Coweta, Oklahoma	New treatment plant	A
	City of Jenks, Oklahoma	New treatment plant	A
	City of Boynton, Oklahoma	Add secondary treatment	B
	City of Kiefer, Oklahoma	Add secondary treatment	B
	City of Mounds, Oklahoma	Add secondary treatment	B
	City of Muskogee, Oklahoma	Add secondary treatment	B
	City of Tulsa, Oklahoma (Southside Plant)	Add secondary treatment	B
	City of Braggs, Oklahoma	Add final settling	B
	City of Sapulpa, Oklahoma	Plant expansion	B
	City of Quinton, Oklahoma	Add secondary treatment	B
	City of Sallisaw, Oklahoma	Add final settling	B

Location	Responsibility	Need	Priority
Waste Treatment (Continued)			
5	City of Howe, Oklahoma	New treatment plant	A
	City of Heavener, Oklahoma	Abandon old plant and pump waste to new plant	B
	City of Mansfield, Arkansas	New treatment plant	A
6	City of Perkins, Oklahoma	New treatment plant	A
	N. Drake San. Dist. Cushing, Oklahoma	New treatment plant	A
	City of Jennings, Oklahoma	Add secondary treatment	B
	City of Marshall, Oklahoma	Add secondary treatment	B
	City of Drumright, Oklahoma	Add final settling	B
	City of Glencoe, Oklahoma	Add final settling	B
7	City of Sublette, Kansas	Plant expansion	B

Location	Responsibility	Need	Priority
Waste Treatment (Continued)			
7	City of Guthrie, Oklahoma	Add final settling	B
	City of Bethany, Oklahoma	Plant expansion	B
	City of Crescent, Oklahoma	Plant expansion	B
	City of Cushing, Oklahoma	Plant expansion	B
	City of Enid, Oklahoma	Plant expansion	B
	City of Fairview, Oklahoma	Plant expansion	B
	City of Hennessey, Oklahoma	Plant expansion	B
	City of Kingfisher, Oklahoma	Plant expansion	B
	City of Okeene, Oklahoma	Plant expansion	B
8	City of Sharon, Kansas	Plant expansion	B
	City of Anthony, Kansas	Plant expansion	B
	City of Braman, Oklahoma	Add final settling	B
	City of Pond Creek, Okla.	Add secondary treatment	B

Location	Responsibility	Need	Priority
Waste Treatment (Continued)			
8	City of Tonkawa, Oklahoma	Add final settling	B
	City of Wakita, Oklahoma	Add final settling	B
	City of Billings, Oklahoma	Add secondary treatment	B
9	City of Clearwater, Kansas	Plant expansion	B
	City of Kingman, Kansas	Plant expansion	B
Natural Salt Pollution Control			
Sources I, II, III, IV, XII	Corps of Engineers	Construct structures to reduce natural brine emissions	A
Flow Regulation			
1	U. S. Department of the Interior, Bureau of Reclamation	Storage is needed now to provide an additional flow of 4,000 acre-feet per year in the Arkansas River below Wichita, Kansas	A
Other Pollution Control Practices			
Basinwide	States' water pollution control	Reduce the quantity of mineral pollutants released by man's activities	A
2 (vicinity of El Dorado, Kansas)	State of Kansas	Examine feedlot operations and require control of drainage and/or treatment	A

Location	Responsibility	Need	Priority
Institutional Practices			
Portion of basin in Kansas & Oklahoma	States of Kansas and Oklahoma	Increase appropriations to provide funds to locate and plug abandoned oil and gas wells	B
Basinwide	States of Colorado, Kansas, Oklahoma and Arkansas	Consider legislation to provide appropriations for state participation in grants and loans for construction of sewage treatment works	B
Basinwide	State of New Mexico	Provide increased appropriations for State grant program for construction of sewage treatment works	B
Basinwide	States of Colorado, New Mexico, Kansas, Oklahoma, and Ark.	Prepare and adopt water quality standards on interstate and intrastate streams	B
Basinwide	States of Colorado, New Mexico, Kansas Oklahoma and Ark.	Consider expansion of water quality control surveillance program (including treatment plant operation and maintenance)	A
Basinwide	States of Colorado, New Mexico, Kansas, Oklahoma and Ark.	Prepare and maintain a complete industrial waste discharge inventory for industries not connected with municipal treatment systems	B
Research			
Kansas	State of Kansas and FWPCA	Determine methods for handling and treating large quantities of animal wastes	B
Main Stem of Arkansas River	FWPCA	Conduct a study to determine the effect of the dam and reservoir construction program along the Arkansas River on water quality, flow, and stream and lake ecology.	B

Location	Responsibility	Need	Priority
Research (Continued)			
Portion of basin in Kansas and Oklahoma	States of Kansas and Oklahoma, FWPCA, Corps of Engineers	Conduct research on the methods for control and/or disposal of brines from natural and manmade sources, particularly those associated with oil field operations	A

III. Immediate Control Needs

Various measures are needed to control existing and potential water pollution of the Middle Arkansas River and its tributaries extending from Great Bend, Kansas, to Fort Smith, Arkansas. These measures will result in reduction of mineral concentrations, abatement of septic conditions and increase in dissolved oxygen content in order to improve and preserve water for municipal and industrial water supply, propagation of fish and wildlife, recreation and irrigation.

The actions recommended here though not all encompassing are, however, prerequisite to good water quality planning and should be included in local, state, and Federal programming for water pollution control. Background for these immediate needs is summarized in Chapter VI.

Waste Treatment

The cities of Willowbrook and Haysville, Kansas; Coweta, Howe, North Drake Sanitary District (Cushing) and Jenks, Oklahoma; and Mansfield, Arkansas, need primary and secondary treatment facilities for their present untreated discharges. At Perkins, Oklahoma, all facilities are obsolete or unsuitable and need to be replaced. Industrial wastes from the American Salt Company in Lyons, Kansas, and McConnell Air Force Base in Wichita, Kansas, should be disposed of by injection into underground strata.

There are also municipalities scattered throughout the river basin that do not provide waste treatment facilities that meet state requirements. To meet the state requirements, 8 complete new treatment plants are needed; 16 plants need secondary treatment; 20 plants need additional capacities;and 13 plants need other modifications in their treatment and/or disposal methods. The list of needs is not considered all inclusive and does not reflect projected needs due to future obsolesence or to expanded or changed water use.

Natural Pollution Control

The single most important water pollution control need in this basin is the construction of control structures as proposed by the Corps of Engineers at five natural brine emission areas to reduce the quantity of mineral pollutants released.

Flow Regulation

Maintenance of higher low flows in the Arkansas River downstream from Wichita, Kansas, is needed to protect the stream for propagation of fish, recreation, and aesthetics. Storage to be used for supplementing low flows could best be provided in a Bureau of Reclamation reservoir proposed for construction on the Ninnescah River. Quality control water could be released to the point of need, upstream from Wichita's waste discharge, through a gravity canal system. It is estimated that the yield of the proposed reservoir, 65,600 acre-feet per year, would provide adequate supplemental flows until the year 2045.

Other Pollution Control Practices

Increased surveillance and enforcement actions by the States of Kansas and Oklahoma are needed to reduce the quantity of mineral pollutants released to surface drains by man's activities.

State programs are needed to examine all animal feedlot waste disposal practices and require drainage control and/or waste treatment if necessary to prevent stream pollution.

Institutional Practices

To strengthen the states' position on prevention, control and abatement of stream pollution, water quality standards are needed on interstate and intrastate streams. State participation is needed in Colorado, Kansas, Oklahoma, and Arkansas in the waste treatment plant construction grants program to accelerate the construction of needed improvements. The State of New Mexico needs to increase the appropriations for its present grant program for the construction of sewage treatment works. Increased surveillance of municipal and industrial waste treatment plants is needed to locate and identify existing or potential pollution problems. For more rigid control over industrial pollution and to aid in solving complex stream quality problems, a complete and up-to-date inventory is needed of industrial waste discharges, listing quantity and quality of effluent and other pertinent data.

In Kansas and Oklahoma appropriations are needed for locating and plugging abandoned wells that are discharging brines to surface drains or into shallow ground water bodies.

Research

Further research by the Federal Water Pollution Control Administration and the State of Kansas is needed to determine methods for treatment of animal wastes.

The Federal Water Pollution Control Administration should conduct a study to determine how the dams and reservoirs in Oklahoma which are proposed, under construction, or already existing on the Arkansas River and major tributaries thereto will effect the stream and lake ecology, water quality, and flow of the Arkansas River.

Research by the Federal Water Pollution Control Administration, Corps of Engineers, and the States of Kansas and Oklahoma is needed to determine economically feasible methods of control and/or disposal of brines originating from natural and man-made sources.

IV. Costs

The estimated cost of pollution control measures listed in the summary table is shown in the following tabulation:

Item	Estimated Costs
Municipalities:	
New treatment facilities	$ 730,000
Expansion or modification of treatment facilities	9,333,000
Industries:	
Expansion or modification of treatment facilities	520,000
Military Installation:	
Injection well for industrial waste	23,000
Federal Reservoirs:	
Construct vault toilets - Keystone Reservoir	140,000
Storage in Bureau of Reclamation Res. and canal system - Ninnescah River FIRST COST	29,300,000
Natural Brine Emission Areas:	
Build control structures to reduce quantities released	208,100,000
Animal Feedlot Drainage:	
The estimate includes only the cost for initial construction of waste retention ponds to prevent slug loads of feedlot drainage from entering streams during heavy rainfall periods. These ponds would not provide "treatment of the waste. Costs for treatment would greatly exceed the amount shown.	100,000
Brine Emission From Abandoned Wells:	
The estimate represents an arbitrary amount to be appropriated yearly to be used to plug abandoned wells.	200,000
TOTAL COST	$248,446,000

Of the total cost, approximately $238,753,000, exclusive of research cost, would be needed for control measures listed under priority "A" in the summary table.

V. Recent Progress in Pollution Control

Municipal Wastes

Pollution control agencies in the States of Colorado, New Mexico, Kansas, Oklahoma, and Arkansas have been very successful in encouraging proper disposal of municipal wastes. In the middle Arkansas River Basin, more than 80 percent of the population is served by sewage treatment plants that provide primary and secondary treatment. Operation of these plants is monitored by state control agencies and assistance is provided where needed.

In the Middle Arkansas River Basin, 64 new municipal waste treatment plants have been completed since 1957 and 24 waste collection and disposal systems have been expanded. Approximately $13,000,000 of the construction was eligible for Public Law 660 grants.

Pollution Resulting from Oil and Natural Gas Production

Effective June 1, 1966, an order issued by the Corporation Commission of Oklahoma, requires that all earthen pits used for the handling, storage, or disposal of deleterious substances produced, obtained, or used in connection with the drilling or operation of wells or the refining or processing of oil or gas must be sealed with an impervious material and operated in such a manner as to prevent the escape of any deleterious substances. This action is a major step in pollution control. More than 80 percent of the brines produced by the oil and gas industry are now reinjected into underground strata, yet unlined pits still allow large quantities of pollutants to escape and degrade ground and surface water resources. Sealing of the earthen pits is to be completed in 1967.

Natural Brine Emissions

A cooperative study was completed by the Corps of Engineers and the Public Health Service DWS&PC (now FWPCA) to determine methods and means of improving and managing water quality in the Arkansas and Red River Basins. The study revealed that construction of projects for controlling natural brine emissions is technically practical and is economically justified. This is the first step to control natural brine emissions which will result in widespread water quality improvements.

VI. Background

Pertinent Basin Characteristics

The Arkansas River originates on the eastern slopes of the Rocky Mountains in Lake County, Colorado. From its source, the river drops rapidly through a relatively narrow canyon until it emerges through the Royal Gorge near Canon City, Colorado, into the Great Plains region. In the middle portion of the basin from Great Bend, Kansas, to the Arkansas state line, the average fall of the river is about 3 feet per mile. The total drainage area of the river watershed above the Arkansas state line is 149,900 square miles. A little less than 25 percent of this area is above Great Bend. The length of the main stem in the middle basin is 499 miles.

A large portion of the river's flow above Great Bend, Kansas, is utilized for irrigation. Flow from the upper Arkansas Basin into the middle basin is very small. Below Great Bend, tributaries are large and numerous and the stream flow increases to the mouth. At Great Bend, flow in the river is less than 45 cfs 20 percent of the time while at Arkansas City, Kansas, the flow is greater than 305 cfs 80 percent of the time. At the Arkansas state line the flow has increased substantially and is greater than 15,000 cfs 80 percent of the time.

The Cimarron River, the major tributary in the Middle Arkansas River Basin, originates in northeastern New Mexico and flows in an easterly or southeasterly course across portions of New Mexico, southeastern Colorado, southwestern Kansas, and northern Oklahoma to its junction with the Arkansas River, 17 miles above Tulsa. The stream is 600 miles in length and drains 18,060 square miles. Flow varies from an average of 26 cfs near Kenton, Oklahoma, to an average of 1,233 cfs near Perkins, Oklahoma.

There are no reservoirs on the main stem of the Arkansas river in Kansas and only one large reservoir (Cheney) on tributary streams. However, several Corps of Engineers projects are under construction both on the main stem and on tributaries in Oklahoma. These projects, with the exception of Kaw Reservoir on the main stem near Ponca City, are included in a multiple-purpose plan for development of the entire Arkansas River Basin. The plan involves the integration of developments for navigation, flood control, hydroelectric power and related features into a single overall project. Upstream reservoirs now in operation which directly serve the navigation feature of the multiple-purpose plan are Keystone on the Arkansas River, Oologah on the Verdigris River, and Eufaula on the Canadian River. Other reservoirs incorporated in and contributing to the proper functioning of the

project include Pensacola, Markham Ferry, and Fort Gibson on the Grand (Neosho) River, and Tenkiller Ferry on the Illinois River. (Description of the water pollution control needs on these streams is contained in the Immediate Needs Reports covering the Grand (Neosho) and Illinois Rivers). These reservoirs are in operation. Lock and Dam Nos. 14, 15, and 16 are under construction on the main stem of the river. Storage in the reservoirs discussed is allocated for flood control, power, water supply, recreation, and the preservation of fish and wildlife. No storage is allocated for quality control.

The population of the Middle Arkansas River Basin, as defined in this report, is approximately 1,400,000. Major population centers are Hutchinson, Wichita, and Arkansas City in Kansas, and Ponca City, Tulsa and Muskogee in Oklahoma. These cities contain about 50 percent of the total population of the basin.

Water Quality

The Arkansas River has been severly damaged by mineral pollutants. The chemical quality of river water is very poor in the entire reach of stream included in the middle basin, as defined in this report (see Figure 1). At Hutchinson, Kansas, chloride concentrations exceed 250 mg/l about 83 percent of the time. The quantity of pollutants added to the stream at various points is such that large volumes of water of excellent quality discharged into the river from major tributaries do not serve to restore the quality of the main stem. At the Arkansas state line the chloride concentration exceeds 250 mg/l about 54 percent of the time. Table 1 shows typical mineral concentrations of the Arkansas River and major tributaries.

Beneficial uses of the Arkansas River include navigation, recreation, hydroelectric power production and the propagation of fish and wildlife.

Table 1

CHEMICAL QUALITY OF ARKANSAS RIVER AND TRIBUTARIES

Station	Typical Concentrations in mg/l		
	Dissolved Solids	Sulfates	Chlorides
Arkansas River Great Bend, Kansas	798	316	44
Rattlesnake Creek	2020	137	1100
Little Arkansas River	182	33	34
Ninnescah River	481	29	155
Walnut River	465	89	115
Arkansas River Arkansas City, Kansas	950	107	340
Chikaskia River	305	24	49
Medicine Lodge River	600	242	65
Salt Fork	1630	233	738
Cimarron River	1800	202	834
Verdigris River	213	37	50
Grand (Neosho) River	160	35	12
Illinois River	105	6	10
Canadian River	402	56	133
Poteau River	53	10	4
Arkansas River Van Buren, Arkansas	780	58	270

Source: U. S. Geological Survey

Present Water Quality Problems

The quality of surface waters in the Middle Arkansas River Basin is altered by natural brine emissions, municipal and industrial discharges, animal feedlot drainage, and brines from oil and natural gas production. Problems associated with these quality alterations are discussed below.

Natural Brine Emissions

Widespread mineral pollution in the Arkansas River Basin has damaged many streams to such an extent that their use for consumptive purposes is severly restricted. In the main stem of the Arkansas River, water cannot be used for dependable municipal supplies from Pueblo, Colorado, to Van Buren, Arkansas, and very limited industrial uses are possible. In fact, for many years the river was used primarily for waste disposal. Now rather extensive non-consumptive uses such as navigation, recreation, power production and propagation of fish and wildlife are being developed.

Through two years of continuous mineral monitoring, the Public Health Service DWS&PC (now FWPCA), (1961-62), measured a daily average of 20,000 tons of salt (as NaCl) in the Arkansas River (measured at Van Buren, Arkansas). This pollution enters waters of the basin principally as concentrated brine from both natural and manmade sources. However, significant quantities of minerals are also carried to streams with agricultural wastes, seepage from widespread gypsum deposits and industrial discharges.

The Public Health Service DWS&PC (now FWPCA) survey was devoted primarily to the task of locating and examining sources of natural brine emissions. Pollution from natural brine emission begins in southern Kansas and western Oklahoma. Five major sources, designated as sources I, II-III, IV and XII in the Public Health Service report and on Figure 1 in this report, account for about 70 percent of the total salt load carried past Tulsa, Oklahoma, each year (53 percent of load carried past Van Buren, Arkansas).

About 71 percent of the chloride released to the stream system by brine emissions comes from sources II and III on the Cimarron River. Approximately 22 percent comes from source I, 4 percent from source IV and 3 percent from source XII.

Planning studies by the Corps of Engineers revealed that engineering solutions to the collection and control of large volumes of brine are generally unique. However, it has been estimated that control structures can be constructed so that approximately 90 percent of the

brine emissions could be contained at the sources. Table 2 briefly describes projects proposed by the Corps of Engineers for control of the natural brine emissions. Estimated costs (January 1966 price levels) are also known.

Natural pollution also occurs in the Whitewater, Ninnescah, and Medicine Lodge River Basins but methods for controlling these sources have not been developed.

Cow Creek below Lyons, Kansas

American Salt Company at Lyons, Kansas, discharges highly mineralized waste water directly to Cow Creek. Chloride concentrations in the stream frequently exceed 1,000 mg/l and dissolved solids often exceed 2,000 mg/l. Quality degradation prevents beneficial use of the stream.

Arkansas River below Wichita, Kansas

Secondary sewage treatment plant effluent discharged to the Arkansas River at Wichita, Kansas, has caused a depletion of the dissolved oxygen and nuisance conditions detrimental to use of the stream for fisheries and recreation.

In a 1960 report, the Kansas Water Resource Board indicated that to prevent pollution problems the desirable minimum flow in the Arkansas River at Wichita should be 200 cfs. A study of stream flow characteristics shows that this minimum flow will not be met almost 35 percent of the time. Reservoir storage is needed now to provide an estimated 4,000 acre-feet of water per year to supplement low flows in the river and by 2070 it is estimated that 125,000 acre-feet per year will be required.

Animal Feedlot Drainage

Fish kills related to animal feedlot operations have occurred in the Walnut River below El Dorado, Kansas, in the Ninnescah River below Pratt, Kansas, and in other streams of the Middle Arkansas River Basin.

Animal wastes have long been identified as significant sources of pollution. Investigations by the Kansas State Department of Health have shown that runoff from cattle feedlots following rainfall is characterized by a high biochemical oxygen demand, high ammonia content, and heavy bacterial populations. Pollution from feedlots is transported by surface runoff and therefore discharges to streams only as long as the runoff continues. This results in a slug load of organic material on a receiving stream that can be damaging, producing nuisance conditions, health hazards, and fish kills.

Table

NATURAL BRINE EMISSION SOURCES
MIDDLE ARKANSAS RIVER BASIN

Salt Source	Type Emission, Extent, Size	Proposed Control Structures	Cost (Million Dollar)
Source I			
Great Salt Plain (Salt Fork of Arkansas River near Jet, Okla.)	30 sq. mile salt flat immediately above Great Salt Plains Reservoir; saturated brine about 1½ feet below ground surface at edge of salt flat	Dike for diversion of fresh water around Great Salt Plains Reservoir. Use of reservoir for evaporation pond	36.2
Source II & III			
Big Salt Plain (Area II) (Flood plains of Cimarron River near Edith, Okla.)	8 sq. mile of deeply encrusted salt plains. Numerous small springs and seeps. Base flow of brine to stream is approx. 10 cfs	Because of their proximity, Areas II and III are treated as one source. Construct system of dams and channels. Divert fresh water around salt plains. Store brine for evaporation	131.2
Little Salt Plain (Area III) (Flood plains of Cimarron River Buffalo, Okla.)	2 sq. mile of deeply encrusted salt plains. Numerous small springs and seeps. Base flow of brine to stream is approx. 2 cfs		
Source IV			
Salt Creek (Tributary & Cimarron River near Southard, Okla.)	Numerous small brine springs emerging from all levels of the escarpment in canyons at head of creek. Base flow of brine to creek is approx. 1 cfs	Brine reservoir to contain all surface runoff and flow from seeps and springs	5.8
Source XII			
Rattlesnake Creek (Tributary of Arkansas River near Raymond, Kansas	Brine seeps and springs in creek bed for a distance of 20 miles above two salt marshes. Base flow of brine to stream is approx. 2 cfs	Diversion of fresh water to Ninnescah River. Low flow dam and pumping facilities to collect brine. Impoundment reservoir	34.9

There are approximately 60 cattle feedlots with over 300 head feeding capacity in the Middle Arkansas River Basin. About 20 of these lots have capacities of over 1,000 head. The total feeding capacity in the basin is approximately 100,000 head. Almost 75 percent of the lots are located in Kansas with the heaviest concentration in the El Dorado, Newton, Wichita, Wellington area. There are also some large lots in the Pratt and Ulysses areas.

Only a small number of the feedlots in the basin now provide proper waste disposal. The Kansas State Department of Health has been actively engaged in development of a control system. Other states in the basin have not been very much concerned with the feedlot waste disposal since they have not yet experienced any serious pollution problems.

Manmade Mineral Pollution

Even with control of natural brine emissions, mineral concentrations in the Cimarron and Arkansas River will frequently exceed maximum limits normally recommended for drinking water. Table 3 shows the percent of time the chloride constituent of the salt will exceed the desirable limit (250 ppm) with maximum (90%) anticipated control of natural brines. The data of Table 3 indicates that pollutants in the form of chlorides resulting from man's activities contribute significantly to stream quality degradation in the basin.

Brines entering the basin streams as a result of man's activities are primarily the consequence of petroleum and natural gas production scattered over practically all of the basin. A large portion of the present stream pollution results from seepage of brines that were discharged to shallow ground water bodies many years ago. Most of the brines collected now in oil and gas production operations are injected into deep wells. The state water pollution control agencies of Kansas and Oklahoma report that now over 95 percent of the brine produced is being reinjected into oil and gas producing strata for pollution control or secondary recovery. The remainder of the brine is normally held in evaporation ponds. Brines escape from ponds and improperly plugged wells, though, making oil and natural gas production areas active pollution sources.

Oil and natural gas production, however, is not the only source of mineral pollution created by man's activities. Irrigation wastes in Colorado and Western Kansas and industrial discharges over the entire river basin contribute large quantities of minerals to the river system. If the quality of the Arkansas River is to be upgraded to provide water for municipal and industrial supplies, more stringent control of mineral pollutants produced by man's activities will be necessary.

Table 3

PERCENTAGE OF TIME OF VARIOUS CHLORIDE CONCENTRATIONS
ARKANSAS AND CIMARRON RIVERS

Station	Percent of Time Chloride Concentration Exceeds Value Below								
	Existing Conditions			With Maximum Control of Natural Brines			With Maximum Control of Natural and Man-Made Brines		
	250 ppm	300 ppm	400 ppm	250 ppm	300 ppm	400 ppm	250 ppm	300 ppm	400 ppm
Arkansas River									
Hutchinson, Kansas	83	78	67	70	60	42	59	32	2
Arkansas City, Kansas	66	58	33	59	47	11	5	2	0
Ralston, Oklahoma	92	84	57	40	20	3	0	0	0
Keystone Res. Okla.	99	97	89	30	8	0	0	0	0
Van Buren, Arkansas	54	44	29	1	0	0	0	0	0
Cimarron River									
Waynoka, Oklahoma	100	100	100	90	85	80	85	80	75
Perkins, Oklahoma	100	100	100	100	97	95	95	90	83

Source: Corps of Engineers

Other Areas

Throughout the Middle Arkansas River Basin there are many small problems of water pollution in streams receiving waste discharges from communities having inadequate treatment facilities. The communities are tabulated in the summary table and are shown on Figure 1. Some communities - Willowbrook and Haysville in Kansas; Coweta, Howe, Jenks and N. Drake San Dist. (Cushing) in Oklahoma, and Mansfield in Arkansas - discharge raw sewage to local streams causing nuisance conditions and health hazards. Nuisance conditions are also caused where McConnell Air Force Base in Wichita, Kansas, discharges waste water from aircraft washing operations directly to storm drains without treatment.

Local nuisance conditions are often created where municipal waste treatment plants discharge their effluent into dry water courses which convey storm runoff to the Arkansas River or its tributaries. Many streams in the basin that receive sewage treatment plant effluent are occasionally dry or experience periods of extremely low flow.

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